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ENGINEERING EVALUATION AND COST ANALYSIS FOR THE FORMER USS WASHTENAW COUNTY (LST-1166)

REVISION 0

Submitted to:

U.S. Environmental Protection Agency
Region 10
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EPA Task Order No.	**001**
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EXECUTIVE SUMMARY

This Engineering Evaluation/Cost Analysis (EE/CA) Report addresses the former USS Washtenaw County, a 2,590-ton *LST-1166* class tank landing ship (hereinafter referred to as LST-1166), which is currently located in the Columbia River near Dibblee Point, Columbia County, Oregon.

The United States Coast Guard (USCG) has tasked the United States Environmental Protection Agency (EPA), under a Pollution Removal Funding Authorization (PRFA) dated 2 September 2010, with preparation of the EE/CA Report for LST-1166. The EPA has subsequently contracted TechLaw, Inc. (TechLaw) under Contract Number EP-S7-06-03 and Technical Direction Document (TDD) 10-12-0040 to assist with the preparation of this EE/CA Report.

This EE/CA Report has been completed as required by 40 Code of Federal Regulations (CFR) 300.415(b)(4) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and was prepared using *Guidance on Conducting Non-Time Critical Removal Actions under CERCLA*, EPA/540-R-93-057, dated August 1993 (EPA 1993).

LST-1166 is currently located at Dibblee Point along the south bank of the Columbia River, south of Lord Island at River Mile No. 63 (Figure 1). It is located approximately 4.5 miles west-northwest of Rainier, Oregon and approximately 1.25 miles downstream and south of Longview, Washington. LST-1166 is located in the DELENA United States Geologic Service (USGS) topographic map quadrangle at 46° 7'17.82" N 123° 0'52.24"W.

The vessel is currently owned by Washtenaw County LST-1166, LLC a defunct non-profit organization. The current owner originally purchased the vessel with the intent of converting it to a maritime museum. In 2002, the vessel was towed to its current location and some refurbishing was conducted; however, conversion to a maritime museum was not successful.

On May 29, 2003 Washtenaw County LST-1166, LLC formerly doing business as Amphibious Forces Memorial Museum (AFMM) purchased the vessel. The company was administratively dissolved on August 4, 2006, and then reinstated on September 24, 2007. The USCG Sector Portland has issued three Administrative Orders and a Captain of the Port (COTP) order to the owners for environmental cleanup and mitigation of the potential threats from the vessel, but the owner has not complied. Furthermore, the Certificate of Financial Responsibility (COFR) Guarantor for the vessel, Lloyd's of London, cancelled the COFR as of February 7, 2008.

The USCG and EPA plan to eliminate access to LST-1166 due to unacceptable exposure risks to human and ecological receptors from contamination which remains on LST-1166 including polychlorinated biphenyl (PCB) contamination in interior paint exceeding 50 parts per million

(ppm), asbestos containing material (ACM), friable paint containing lead, and wiring insulation containing polychlorinated biphenyls (PCBs). The USCG and EPA have elected to remove and dispose of LST-1166 to address these unacceptable exposure risks to human and ecological receptors and intend the selected remedial alternative to be the final action for LST-1166, resulting in no further action.

The LST-1166 is clearly within the USCG's Area of Responsibility (AOR) for which it is the lead agency for response incidents under the NCP and the Area Contingency Plan (ACP). This includes spill responses and removal actions conducted pursuant to the federal Clean Water Act (CWA) as amended by the Oil Pollution Act of 1990 (OPA), and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Due to the presence of elevated levels of PCBs onboard the vessel, disposal of PCBs on the LST-1166 in the ocean is also covered by the Toxic Substances Control Act (TSCA).

The goal of the EE/CA is to effectively address the human health and ecological risks identified within the streamlined risk evaluations. The scope corresponds to the following removal factors identified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP):

- Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
- Actual or potential contamination of drinking water supplies or sensitive ecosystems;
- Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;
- The availability of other appropriate federal or state response mechanisms to respond to the release; and
- Other situations or factors that may pose threats to public health or welfare of the United States or the environment.

The Site characterization information, and identification and analyses of the removal action alternatives presented in this EE/CA are based on the findings and investigations conducted by USCG and EPA and information obtained from various sources.

To address the removal action objectives and scope, a limited number of alternatives were assembled from applicable technologies and options. The technologies and options considered include: Decontamination, Recycling, Treatment and Disposal.

Three removal alternatives were assembled and analyzed.

Alternative 1: Ocean Disposal with Limited Decontamination

Alternative 2: Ocean Disposal with Full Decontamination

Alternative 3: Decontamination, Dismantling and Recycle/Disposal

The alternatives were subsequently evaluated with respect to implementability, effectiveness and cost. Based on the findings of the individual and comparative analyses, Alternative 1 is the recommended removal action.

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ABBREVIATIONS AND ACRONYMS

ACM	Asbestos Containing Material
ACP	Area Contingency Plan
AFMM	Amphibious Forces Memorial Museum
AOR	Area of Responsibility
ARAR	Applicable or Relevant and Appropriate Requirements
BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COFR	Certificate of Financial Responsibility
COPC	Constituents of Potential Concerns
COTP	Captain of the Port
CWA	Clean Water Act
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
F	Fahrenheit
GIS	Geographic Information System
GP	General Permit
mcy	million cubic yards
mcy/yr	million cubic yards per year
mph	miles per hour
mg/kg	milligram per kilogram
mg/L	milligram per liter
mm	millimeter
MPRSA	Marine Protection Research and Sanctuaries Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NTCRA	Non-Time Critical Removal Action
O&M	Operation & Maintenance
OPA	Oil Pollution Act
OSLTF	Oil Spill Liability Trust Fund
PCB	polychlorinated biphenyl
PEO	Program Executive Office
ppm	parts per million
PRFA	Pollution Removal Funding Authorization
PRSC	Post Removal Site Control
RAO	Remedial Action Objective
TSD	Treatment, Storage and Disposal
TDD	Technical Direction Document
TSCA	Toxic Substances Control Act
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOJ	United States Department of Justice
USGS	United States Geologic Service

1.0 SITE CHARACTERIZATION

This section of the Engineering Evaluation/Cost Analysis (EE/CA) presents general information regarding the vessel including the location, operations and history of the vessel. The environmental setting of the area is described along with the adjacent land use, population near the site, meteorology, and sensitive ecosystems. Previous response actions that have been conducted are also described. Information related to source, nature and extent of contamination associated with the vessel are provided. A streamlined risk evaluation is presented to provide a basis for evaluating whether the response actions recommend in this EE/CA protect human health and the environment.

1.1 Site Description and Background

Site description including description of the hydrology and sedimentation characteristics of the Columbia River, topography, land use and climate are discussed below.

1.1.1 Vessel Location

LST-1166 is currently located at Dibblee Point along the south bank of the Columbia River, south of Lord Island at River Mile No. 63 (Figure 1). It is located approximately 4.5 miles west-northwest of Rainier, Oregon and approximately 1.25 miles downstream and south of Longview, Washington. LST-1166 is located in the DELENA United States Geologic Service (USGS) topographic map quadrangle at 46° 7'17.82" N 123° 0'52.24"W.

Columbia River

The Columbia River navigation channel begins at the Columbia River bar and continues five miles upriver at a depth of 55 feet and a width of 2,640 feet. After which, it maintains a depth of 43 feet and a width of 600 feet for 100 miles to the Portland Harbor. The Barlow Channel, which runs adjacent to the LST-1166, has an approximate depth of 40-43 feet (NOAA *undated*).

The Lower Columbia River Valley contains deep alluvial deposits of sand, and some silt and gravel. The source of the fine grained sediment is the upper basin, east of the Cascade Mountains. Streams flowing from the Cascades Mountains produced most of the sand supply. The riverbed of the main channel consists of primarily fine to medium sand [0.125-0.50 millimeter (mm)] with fine sediments comprising less than 5 percent of the bed material of the river channel. The location of the Columbia River channel has been stable for 6,000 years (USACE *undated*).

The USGS measures the annual discharge for the Columbia River at The Dalles, Oregon at River Mile 194. The average annual discharge for 1879-1999 was 86,175,360 US gallons per minute. Sand transport in the lower Columbia River is driven by the river discharges. Annually, the lower Columbia River sand transport is highly variable ranging from approximately 0.1 million cubic yards (mcy) in 1926 to over 37 mcy in 1984.

Over the long-term, lower discharges and reservoir flow have caused persistent reductions in sand transport in the Columbia River. The high discharges prior to 1900 produced an average total sand transport of 9.1-mcy/yr. The lower natural stream flows during 1900-1936 caused the total sand transport for the period to fall to an average of 3.8-mcy/yr. From 1936 to 1974 sand transport had dropped to an average of 3.2-mcy/yr. Since 1975, flow regulation has reduced spring freshet discharges and the average annual sand transport has declined to 1.3-mcy/yr (USACE *undated*).

Based on United States Army Corps of Engineers (USACE) documentation, historical data regarding accretion volumes is limited for much of the lower Columbia River. Sediment volumes were only collected at the estuary, and were collected primarily from the time periods 1879 through 1935 and 1935 through 1958. The annual estuary accretion rate was 5.0 mcy/yr from 1879-1935 and 3.3 mcy/yr from 1927-1958. Because of the decreased annual sand transport volume, it was concluded to be likely that there has been a corresponding decrease in the volume of sand accretion for the Columbia River (USACE *undated*).

The Bathymetric Atlas of the Columbia River Estuary contains additional data on accretion levels from 1982 (Columbia River Estuary Data Development Program 1983). According to Mr. James Crammond the Director of the USGS Oregon Water Science Center, there are current studies being conducted on sedimentation rates, but they have not been published or released to the general public at this time (USGS 2011).

1.1.2 Vessel History

LST-1166 was built in Sturgeon Bay, Wisconsin. It was commissioned in late October 1953 and served in the western Atlantic and Caribbean areas for two years. At the beginning of July 1955 the ship was renamed the *Washtenaw County*. From January to May of 1956 the ship served in the Mediterranean Sea as a unit of the Sixth Fleet and in mid-January 1958 passed through the Panama Canal to join the Pacific Fleet. *Washtenaw County*'s first regular Western Pacific cruise began in April 1959 and was completed in September.

Washtenaw County spent the next thirteen years participating in Seventh Fleet amphibious training and logistics activities (Photo 1). Beginning in mid-1964 the Washtenaw County was involved in Vietnam War operations. The last of *Washtenaw County*'s wartime assignments

ended in mid-1972. In 1973 the ship underwent conversion to a special minesweeper and in February 1973 was decommissioned. *Washtenaw County* was inactivated at Yokosuka, Japan, in August 1973. The ship was stricken from the Naval Vessel Register late in August 1973 and was sold at the end of January 1975 (Naval History and Heritage Command 2006).

LST-1166 was subsequently purchased by foreign interests. It was registered commercially as Al Manhal I from 1973 to 1980 and as El CentroAmericano from 1980 to 1984. In 1980, LST-1166 was towed to Astoria, Oregon because of mechanical issues, and it has been moored at various locations along both the Willamette and Columbia rivers. In 2002, the owner of the LST-1166 was granted temporary permission to moor at Dibblee Point, approximately 1.25 miles south of Longview, Washington (USCG 2009).

The vessel is currently owned by Washtenaw County LST-1166, LLC a defunct non-profit organization. The current owner originally purchased the vessel with the intent of converting it to a maritime museum. In 2002, the vessel was towed to its current location and some refurbishing was conducted; however, conversion to a maritime museum was not successful.

On May 29, 2003 Washtenaw County LST-1166, LLC formerly doing business as Amphibious Forces Memorial Museum (AFMM) purchased the vessel. The company was administratively dissolved on August 4, 2006, and then reinstated on September 24, 2007. The USCG Sector Portland has issued three Administrative Orders and a Captain of the Port (COTP) order to the owners for environmental cleanup and mitigation of the potential threats from the vessel, but the owner has not complied. Furthermore, the Certificate of Financial Responsibility (COFR) Guarantor for the vessel, Lloyd's of London, cancelled the COFR as of February 7, 2008. They have refused to conduct a cleanup of the vessel. The current owner, Washtenaw County LST-1166, LLC is, for all intents and purposes, financially defunct.

Trespassing appears to have begun in 2004. Reports of vandalism, illegal methamphetamine activity, illegal dumping of waste oil and stripping and theft of metal, wiring, piping, hatches and valves have since occurred (EPA 2010b).

The LST-1166 hull has deteriorated and the vessel has taken on water from an apparent leak. The bottom two decks and the engine room are currently flooded (EPA 2010b).

1.1.3 Surrounding Land Use and Populations

LST-1166 is currently located at Dibblee Point along the south bank of the Columbia River, south of Lord Island at River Mile No. 63 (Figure 1).

Dibblee Point is a 110-acre parcel located just outside the city limits of Rainier, Oregon which is owned by the State of Oregon and managed by the Division of State Lands. Columbia County owns a small parcel of land within the 110 acres and approximately 60 acres is leased by a local sand quarry operation, BC Excavation (no author 2003).

LST-1166 is moored to the bank south of the vessel. This shoreline contains forested river banks, wetlands and open farmlands. Several farms are located within one mile of the vessel with the closest farm within 1/4-mile. Lord Island, located north of LST-1166, primarily consists of wetland and forested land. LST-1166 is bordered east and west by the Columbia River (EPA 2010b).

LST-1166 is located in a semi-remote part of the river; however, this area is extensively used by the public for fishing and it is downstream from a public access beach. The land immediately adjacent to the LST-1166 is used both recreationally and for industrial purposes (EPA 2010).

The closest city to LST-1166 is Longview, Washington in Cowlitz County which has a population of approximately 36,767 (USCB 2006). Drinking water sources for this community include private wells and public water systems, and are tracked by area by the Division of Environmental Health Office of Drinking Water.

1.1.4 Sensitive Ecosystems

The Columbia River supports a wide array of fish, wildlife and sensitive environments. The river has been designated as critical habitat for the two species of federal-listed threatened salmon (e.g., Bull Trout, Steelhead) and is a migratory pathway crucial for the maintenance of steelhead trout. Lord Island, located north of LST-1166, is designated a waterfowl use area and wetland habitat (WA DEP 2003).

1.1.5 Meteorology

The average temperature for the area ranges from 45 degrees Fahrenheit (°F) in the winter months to 76°F in the summer months with an annual average precipitation of 46.17". Wind conditions are generally less than 15 miles per hour (mph) with gusts to 20 mph. (NOAA *undated*).

1.2 Previous Removal Actions and Investigations

1.2.1 United States Coast Guard

On September 7, 2007, the United States Coast Guard (USCG) was notified by local law enforcement authorities that oil was discharging from the LST-1166 into the Columbia River. The USCG immediately conducted an inspection of the ship and confirmed there was a substantial threat of discharge of fuel oil and hazardous substances, due to the deteriorated condition of the vessel. Further investigation revealed that the cause of the sheen was a result of thieves stripping the piping, valves, wire, and hydraulic lines. The evidence of vandalism and theft was documented during this inspection (Photograph 2). During the investigation, the USCG discovered lubricants, solvents, potential asbestos-containing materials, and lead-based paint on and in the vessel.

On November 13, 2007, the USCG issued an Administrative Order (Order) to the vessel owner, USS Washtenaw County – LST1166, LLC, to remove all contaminants from the vessel. The owner held a COFR, which was issued because the vessel operator had demonstrated their ability to pay for cleanup and damage costs in the event of a water pollution incident under the Oil Pollution Act (OPA). The COFR was underwritten by Lloyds of London, who hired a contractor to respond to the Order.

On January 15, 2008, the USCG, pursuant to 40 Code of Federal Regulations (CFR) 229.3 for vessel disposal under the MPRSA, gave the owner 30 days to submit a comprehensive plan. On February 1, 2008, Region 10's Ocean Dumping program receives a request from the underwriter's contractor seeking authorization to use EPA's ocean dumping general permit (GP) to dispose of the LST-1166 at sea. However, on February 15, 2008, the contractor was denied permission because the terms of the GP had not been met - the contaminants on the vessel had not been removed to the maximum extent practicable, as required. Following dissolution of LLC, the underwriters discontinued efforts to comply with the USCG orders.

USCG, in response to the owner's non-compliance with the Order, conducted interim removal activities from July 2008, to January 2009. The materials removed and disposed of during the Removal Action are summarized in Table 1.2.1.

Table 1.2.1: Removal Action Disposal Summary

Total	Unit	Material Description
3,975	Gallons	fuel and oil
8,100	Pounds	oily debris
26,342	Gallons	oily water
465,800	Gallons	water to be treated (water from the lower decks of the vessel)
5,125	Gallons	polychlorinated biphenyl (PCB) oil from forward hydraulics and piping
349,442	Pounds	PCB-contaminated solids
5	Pounds	mercury
4	Pounds	hypodermic needles
120	cubic yards	friable asbestos

In addition to removal of the preceding quantities of materials, the remaining insulation, surfaces, and piping that contained asbestos were encapsulated with a polymer (USCG *undated*).

Funding for the USCG Removal Action included $4,784,283 from the Oil Spill Liability Trust Fund (OSLTF) and $137,036 from the Superfund (USCG 2009). During the Removal Action, the USCG hired armed security guards in an attempt to keep vandals and drug users off the vessel. The USCG began to pursue a cost recovery case against the owner and is currently being pursued by the United States Department of Justice (USDOJ).

In January 2010, the USCG contacted EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program and informed EPA of the USCG's intent to use the GP to dispose of the vessel in the ocean or turn control of the vessel over to EPA for a Remedial Action. This contact initiated EPA's involvement with the investigations and actions at the LST-1166 vessel.

1.2.2 EPA

In January and March 2010, EPA conducted two inspections of the LST-1166 vessel. During these inspections, EPA personnel observed corroded and flaking painted surfaces throughout the interior and exterior of the vessel. Paint chips were observed littering most of the horizontal surfaces and deck floors. Further, paint was observed flaking off external surfaces of the hull and falling into the Columbia River. In addition, an unknown type of oil was observed floating atop the waters that had flooded the lower decks of the vessel, which was estimated at a depth of 20 feet. Foam was also observed to remain filling several rooms and interior spaces of the vessel.

1.3 Source, Nature, and Extent of Contamination

During inspections conducted by EPA in January and March 2010, painted surfaces throughout the interior and exterior of the vessel were observed to be corroding and flaking, with paint chips littering most horizontal surfaces and deck floors. In addition, it was evident that paint was flaking off of external surfaces and the hull and falling into the Columbia River. Correspondence between USCG and EPA confirmed that the interior paint contained both lead and polychlorinated biphenyls (PCBs), while the exterior paint contained only lead. On October 9, 2008, Crescere Marine Engineering, Inc. conducted an estimate of total surface area for paint removal from the vessel. The total paint removal area, including all interior and exterior areas of the vessel, was estimated at 519,456.5 ft^2. The total paint removal area, excluding the exterior of the vessel, was estimated at 447,337.8 ft^2.

EPA observed multiple areas in the vessel that contained insulated wiring. Through correspondence with the USCG, EPA confirmed that the wiring was asbestos-insulated and contained hazardous amounts of PCBs. It was estimated that 60 pounds of PCB-contaminated wiring required removal from the vessel.

EPA observed that several rooms and interior spaces in the vessel were completely filled with foam. Correspondence between the USCG and EPA confirmed that the vessel was “filled” with polyurethane foam. The area of the foam was estimated to be 375 feet in length, 75 feet in width, and between 12 to 14 feet in depth. The foam was reported to be closed cell in nature and all tests reported that there was no contamination in the foam. It was reported that areas of the foam were breached by vandals and had a small amount of asbestos contamination; however, those areas were remediated during the USCG’s cleanup efforts.

During the USCG’s Removal Action that was conducted in 2008-2009, insulation, surfaces, and piping that contained asbestos were encapsulated with a polymer. This encapsulated material was observed by EPA on board the vessel and was estimated to be approximately 80 cubic yards

in volume. In addition, asbestos flooring was present in the mess hall of the vessel. If this flooring is friable, it will require removal from the vessel.

Finally, EPA observed an oily substance floating on the surface of approximately 20 feet of water in the lower decks of the vessel. The flooding occurred during breakage of a seal during the USCG's Removal Action in 2008-2009. No samples were collected to characterize this water.

1.3.1 Analytical Data

Following the Removal Action by the USCG in 2008-2009, USCG's contractor collected multi-media samples from the vessel. The sampling event included: collection of water for metals and PCBs analysis; collection of paint chips for metals and PCBs analysis; and collection of solids and/or oil for metals and PCBs analysis. All of the analytical data from the sampling event was reviewed by the EPA and its contractors. Concentration ranges for the COPC, notably lead and PCBs, in all of the sampling media are summarized in Table 1.3.1. Hard copies of the data are available as part of the Administrative Record held by the USCG.

Table 1.3.1: Sample Results for COPC

Sample ID	Chain of Custody	Sample Method and/or Analytical Method Description	Analytical Result
Hatch-H8[2]	080820-719	Total Recoverable Heavy Metals in Non-potable Water	182 µg/L
R1-Green Paint-005 Dup[1]	080820-719	Heavy Metals in Solids, Paint, and Oil by EPA Method 7000 Series	8200 mg/kg
White Paint Rib 56[1]	081024-923	Heavy Metals in Soil EPA method 7000 Series	71500 mg/kg
7 Stern Floor - Starboard	800902-762-4	PCBs in non-potable water by EPA method 8082/PCBs in wipes by EPA Method 8082	5120 µg/wipe
3 Front Port Hyd Equip. Dup	800902-762-3	PCBs in non-potable wipes by EPA method 8082	4360 µg/L
R25-Blk Insl Covering-013	080820-719	PCBs in Solid Material and Oil EPA method 8082	2160 mg/kg
Portside Bow Oil	080820-719	PCBs in Solid Material and Oil EPA method 8082	361 mg/kg
Paint Room 7	080820-719	PCBs in Solid Material and Oil EPA method 8082	72.6 mg/kg

1.3.2 Constituents of Potential Concerns

Following EPA's assessments that were conducted in January and March 2010, it was confirmed that significant contamination remains on board the vessel including PCB contamination in interior paint, lead contamination in paint, and PCB contamination in wiring insulation. Samples

were collected from flaking paint on the exterior and interior of the vessel. Samples were also collected from the wiring insulation and encapsulated asbestos-containing materials. Sample results confirmed that lead was present in the interior and exterior paint ranging from 3.42 parts per million (ppm) to 8,200 ppm, PCBs were present in the interior paint ranging from <0.5 ppm to 72.6 ppm, and PCBs were present in the asbestos wiring insulation ranging from <0.5 ppm to 2,160 ppm. Table 1.3.2 summarizes the COPCs and the estimated volume of the materials:

Table 1.3.2: Removal Action COPCs

COPC	**Concentration Levels**	**Standard for Removal Action[1]**	**Estimated Area/Volume**
asbestos (sealed)	N/A	Removal of all friable asbestos materials	80 cubic yards
asbestos flooring	N/A	Removal of all friable asbestos materials	Mess Hall only; exact volume unknown
lead paint (exterior surfaces)	3.42 to 8,200 mg/kg	Removal of all deteriorating or friable paint	72,118.7 square feet
PCBs in insulation	<0.5 to 2,160 mg/kg	Removal or encapsulation of wiring with PCB concentrations >50 mg/kg	60 pounds
PCBs/lead in paint (interior surfaces)	<0.5 to 72.6 mg/kg	Removal of all deteriorating or friable paint with PCB concentrations >50 mg/kg	447,337.8 square feet

[1]Standards used during the USCG 2008/2009 removal action
mg/kg – milligram per kilogram

1.4 Streamlined Risk Evaluation

This streamlined risk evaluation for the Site was prepared using the general guidance provided in EPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA (EPA, 1993). This risk evaluation is intermediate in scope between limited evaluation conducted for emergency removal actions and the conventional baseline assessment normally conducted for remedial actions.

The purpose of this evaluation is to identify the constituents of potential concerns (COPCs) using sampling data from the site, provide an estimate of how and to what extent humans and ecological receptors may be exposed to these chemicals, and qualitatively evaluate the health effects associated with the COPCs. The results of this comparison with screening levels will confirm the potential human health and ecological risks posed by the site that justifies a removal action. The comparison will also help to focus the alternatives development by identifying the particular source or sources of contamination and associated risk. Furthermore, the results of the streamlined risk evaluation will provide the basis for developing appropriate cleanup levels as part of the Removal Action.

This streamlined risk evaluation addresses the removal action objective of protecting human health and the environment from exposure to lead-based paint, PCB containing paint, PCB containing electrical wiring in the LST 1166.

Of the total painted surface area aboard the LST-1166, approximately 440,000 square feet are reported to contain PCBs, in concentrations ranging between < 0.5 ppm to 72.6. ppm PCBs. Assuming an estimate of 200 square feet/gallon coverage of paint and assuming an average PCB concentration in the paint to be 50 ppm, it is estimated that the maximum total mass of PCBs in the paint on the LST-1166 is approximately 550 grams. Most of the easily accessible wiring in the vessel has been removed by scavengers for the recyclable copper content. The electrical wiring that remains contains concentrations of PCB that range from <0.50 mg/kg to 2,160 ppm, however the bioavailability potential is much lower than the PCB paint. Lead concentrations in the lead-based painted surfaces ranged from non-detect to 8,000 ppm.

Substances found on LST-1166, including the substances discussed the preceding section, constitute hazardous substances as defined by Section 101(14) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C.§9601(14). Oils present and discharged from LST-1166, also in the preceding section, meet the definition of "oil" and "discharge" as defined in Sections 311(a)(1) and (2) of the Clean Water Act (CWA), 33 U.S.C. §1321(a)(1) and (2) and Sections 100(23) and (7) of the Oil Pollution Act (OPA), 33 U.S.C. §2701(23) AND (7).

This streamlined risk evaluation for the Site assumes any hazardous substances with constituents of potential concern (COPC) pose an actual or potential threat to human health or welfare, or the environment. Additionally, from health and safety standpoint, the materials on the vessel pose a level of risk that warrants removal. Site investigations have adequately defined the extent of the COPCs that are present in source materials to proceed with this EE/CA.

1.4.1 Human Health Risks

Threats from exposure to contaminants onboard the vessel is to both human and ecological receptors. The elevated concentration of hazardous substances and exposure of contaminated surfaces to the environment indicates that inhalation (air) and direct contact (dermal) human exposure pathways potentially exist. Nearby water recreationists and trespassers could also be exposed to the contaminants. Furthermore, the potential for exposure is elevated because the contact of the exterior of LST-1166 is unrestricted to weather and the environment. Open contact with the Columbia River could result in redistribution of contaminants through the open water column and/or sediments.

1.4.2 Ecological Risks

Ecological receptors, including avian, mammalian, fish, and marine plant receptors could potentially be exposed to elevated levels of contaminants found either on the vessel, or in the Columbia River, or sediments contaminated by these materials. Similarly ecological receptors could be exposed through ingestion of paint flakes, water and sediments contaminated by these materials.

Benthic biota are exposed to pollutants accumulated within the sediments and may transfer potentially toxic concentrations through the food web to organisms in higher trophic levels. Aquatic toxicity testing has determined that many animal species are detrimentally affected at very low concentrations of heavy metals (such as lead) and synthetic organics. Indirect and direct exposure to contaminated sediments may have chronic or acute effects on many species. Lead has been found to accumulate in waterfowl to toxic levels through ingestion of sediments (USGS 1998). Benthic invertebrates have been shown to suffer toxic effects from heavy metals, PAHs, and pesticides accumulated in sediments. Potential links have been established between organic contaminants (pesticides, PCBs, dioxin) in sediments and endocrines in fish and other vertebrates and invertebrates (EPA 1998, USGS 1998). Lead-based paint from the vessel has the potential to impact waterfowl such as sturgeon and other bottom feeders.

1.4.3 Conceptual Site Model

Human Health

Paint chips, electrical wiring:

- Ingestion
  - Recreationists – Potentially Complete
  - Trespassers – Potentially Complete
- Inhalation
  - Recreationists – Potentially Complete
  - Trespassers – Potentially Complete
- Dermal
  - Recreationists – Potentially Complete
  - Trespassers – Potentially Complete

Surface water:

- Ingestion
  - Recreationists – Potentially Complete
  - Trespassers – Potentially Complete
- Dermal
  - Recreationists – Potentially Complete
  - Trespassers – Potentially Complete

Sediment:

- Dermal
  - Recreationists – Potentially Complete
  - Trespassers – Potentially Complete

Ecological

Sediment:

- Dermal
  - Benthic Organisms – Potentially Complete
- Ingestion
  - Benthic Organisms – Potentially Complete

1.4.4 Uncertainty Analysis

PCBs in paint are bound in the matrix of the paint solid structure and, as such, are not available in a form that would expose or be bioavailable to marine organisms. PCBs exhibit very low water solubility in water. Therefore, we would not expect these PCB laden paints to leach out free PCBs into the water column. Similarly lead in paint would not readily leach into the water column. Therefore, the risk to human health and environment in this streamlined evaluation may have been overestimated.

2.0 IDENTIFICATION OF REMOVAL ACTION SCOPE, GOALS, AND OBJECTIVES

This section presents the objective(s) for the proposed removal action. The purpose, scope, and scheduling requirements for implementation of the removal action alternatives are also described in this section in order to define removal action requirements based on time, budget, technical feasibility, and relevant criteria and standards.

2.1 Statutory Limits on Removal Actions

The potential removal activities (Alternatives) defined in this EE/CA would primarily be carried out under the CERCLA Section 104(c)(1) which sets limits of $2 million and 12 months for USCG-financed removal actions. Cost and implementation time exemptions may be granted if USCG determines that the removal action is necessary to mitigate an immediate risk to human health, welfare, or the environment or that the removal action is otherwise appropriate and consistent with anticipated long-term remedial action.

To the extent that the removal action or any portion thereof, is to be performed by USCG pursuant to the CWA, the funding source for this work is the OSLTF.

Based on the likely Alternative to be selected and the nature of the activities, the $2 million and 12-month statutory limits apply, however, it is anticipated that an exemption may be necessary, at a minimum for the cost portion. Should the current overall schedule not be suitable based on varied issues/conditions, the exemption may also include an adjusted timeline. As the EE/CA moves through the system and the other required elements are conducted, any exemption requirements will be detailed further within the EE/CA and in the following Action Memorandum as applicable.

2.2 Determination of Removal Action Scope

The removal actions presented within this EE/CA are intended to address the human health and ecological risks identified within the streamlined risk evaluations.

The scope corresponds to the following removal factors identified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP):

- Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
- Actual or potential contamination of drinking water supplies or sensitive ecosystems;
- Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;

- The availability of other appropriate federal or state response mechanisms to respond to the release; and
- Other situations or factors that may pose threats to public health or welfare of the United States or the environment.

2.3 Removal Action Objectives

The goal of this EE/CA is to capture, contain and remove the hazardous materials, oil, and physical hazards, such as loose equipment and mechanical devices, from LST-1166 and properly dispose of the vessel. This includes eliminating the potential for contaminated materials onboard LST-1166 to act as a source to surface water, sediments, soils and ground water, in a manner that is protective of human health and the environment and to attain applicable or relevant and appropriate requirements (ARARs) to the extent practicable.

Remedial Action Objectives (RAOs) consist of goals for protecting human health and the environment and drive the formulation and development of the removal alternatives. The following represent the RAOs for LST-1166:

- Eliminate actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants associated with LST-1166 [40 CFR 300.415 (b)(2)(i)].
- Prevent actual or potential contamination of drinking water supplies or sensitive ecosystems from hazardous substances or pollutants or contaminants associated with LST-1166 [40 CFR 300.415 (b)(2)(ii)].
- Mitigate weather conditions that may cause hazardous substances or pollutants or contaminants from migrating or being released from LST-1166 [40 CFR 300.415 (b)(2)(v)].

The USCG and EPA plan to eliminate access to LST-1166 due to unacceptable exposure risks to human and ecological receptors from contamination which remains on LST-1166. The USCG and EPA have elected to remove and dispose of LST-1166 to address these unacceptable exposure risks to human and ecological receptors and intend the selected remedial alternative to be the final action for LST-1166, resulting in no further action.

2.4 Determination of and Compliance with ARARs and other Criteria

Section 300.415(j) of the NCP provides that removal actions pursuant to CERCLA section 106 attain ARARs under Federal or State environmental laws or facility siting laws, to the extent practicable considering the urgency of the situation and the scope of the removal. In addition to legally binding laws and regulations, many federal and state environmental and public health programs also develop criteria, policies, guidance, and proposed standards that are not legally

binding; however, they may provide useful information or recommended procedures. These "To Be Considered" criteria or "TBCs" are not potential ARARs, but are generally evaluated along with ARARs. Applicable ARARs and TBCs for this EE/CA are defined based on the nature of the contaminants identified and the potential Alternatives, and are further summarized below.

2.4.1 Contaminant Specific ARARs

As defined in Section 1.2, the primary contaminants with pose potential risk are friable lead-contaminated paint, PCB-contaminated paint and wiring insulation containing PCBs in oil. Specific contaminant levels are included in Table 1.3.1.

2.4.2 Location Specific ARARs

The geographic and physical position of the LST-1166 determines the ARARs regarding the concentration of hazardous substances and cleanup activities due to their location in the environment. Potential location-specific ARARs for the LST-1166 include Historic Preservation- the National Historic Preservation Act of 1966 as amended. Public Law 89-665; 80 Stat. 915; 16 U.S.C. 470), the Endangered Species Act (16 USC 1531; 40 CFR Part 6.302; 50 CFR Part 402), Wetlands - Protection of Wetlands Order (40 CFR Part 6), and the Marine Protection Research and Sanctuaries Act (MPRSA) also known as the Ocean Dumping Act.

2.4.3 Action Specific ARARs

Action specific ARARs for include the Clean Water Act, Section 404 (33 CFR Part 336), Wetlands - Protection of Wetlands Order (40 CFR Part 6), Hazardous and Solid Waste, RCRA Subtitle C – Hazardous Waste Characteristics, and RCRA Subtitle D – Non-hazardous Solid Waste (40 CFR Parts 257 and 258).

The general schedule for removal activities, including both the start and completion time for the non-time critical removal action (NTCRA), will be subject to determinations to be made by USCG.

3.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Technologies and options applicable to this removal action were considered and screened. These include:

- Decontamination
- Treatment
- Recycling
- Disposal

A limited number of removal action alternatives were assembled from these technologies and options as viable or appropriate alternatives. Based on the nature and extent of contamination and on the RAOs developed in Section 2.3, three alternatives were assembled for detailed analysis.

3.1 Identification and Analysis of Removal Action Alternatives

The following alternatives have been developed for off-site disposal of LST-1166:

- Ocean Disposal with Limited Decontamination
- Ocean Disposal with Full Decontamination
- Decontamination, Dismantling, and Recycling/Disposal

These options have been developed to provide a range of options (alternatives) to compare effectiveness, implementation and cost in addressing the removal action objectives discussed in Section 2.3.

Based on the identification and analysis of the removal action alternative applicable to this Site, the alternatives are selected for detailed analysis included in the following sections.

3.1.1 Alternative 1: Ocean Disposal with Limited Decontamination

This removal action alternative includes the following actions:

- Pre-removal structural assessment and inspection
- Removal and disposal of approximately 2,000 pounds of solid/hazardous waste
- Removal and disposal of approximately 200 pounds of loose friable paint chips
- Removal and disposal of approximately 400,000 pounds of foam (non-hazardous)
- Removal and treatment of 500,000 gallons of non-oily water

U.S. EPA inspection of the vessel in 2010 indicated the presence of standing water (20 feet deep) in the lower two decks due to a broken seal (U.S. EPA 210a). The water will be pumped out through a carbon filter and discharged back to the river. The seal will be inspected and repaired to ensure water is removed to the extent practicable. The solid/hazardous wastes removed will be disposed off-site at a permitted treatment, storage and disposal (TSD) facility in accordance with state and federal laws. Lead-based paint and PCB paint removal, except for friable chips, would not be conducted under this alternative. The following activities will be carried out to prepare the vessel for disposal.

- Preparation of deck and superstructure
- Preparation of below deck
- Preparation of hull

The above activities include securing all loose equipment including engines, generators, cables, winches, girders, boom arms and other assorted machinery to the ship as a part of preparing the vessel for disposal. Some of the equipment may contain residual oils and will be inspected and residual oils removed. These activities will be conducted in accordance with Marine Protection Research and Sanctuaries Act (MPRSA) also known as the Ocean Dumping Act. The vessel will be then towed to a location approximately 65 nautical miles from the mouth of Columbia River (Figure 2 – Disposal Location Map) and will be scuttled to the bottom of the ocean floor at the depth of approximately 1,000 fathoms (over a mile). Sinking the vessel to the bottom of the ocean will involve mechanical perforation of the exterior hull allowing the ship to flood. The location of the disposal will be mapped using Geographic Information System (GIS). Best management practices (BMPs) and engineering controls will be employed to minimize impact of this removal on human health and the environment. Every effort will be made to complete the towing the vessel to the disposal location during the warm months of May through August.

Effectiveness: This alternative will permanently remove the source of contamination from the current location, eliminate potential exposure routes, and protect public health, the environment and ecology of the Columbia River, and the community. Short-term, there is a potential exposure to the workers preparing the vessel for removal. However, this can be minimized by use of BMPs, engineering controls and appropriate personal protective equipment. This alternative complies with the ARARs identified in Section 2.4, and meets the RAOs as it removes all potential contamination from the current location and no concerns of residual effect exist. The final disposition of the vessel is a long-term solution that will be implemented to address the current conditions and concerns.

Commented [R1]: Lead in here by stating that NOAA conducted a risk assessment and found that….

Commented [MN2]: Please see following page for additional discussion.

At the disposal location, PCB-containing paint, lead-based paint and electrical wiring containing PCBs will remain in place, however, at 1,000 fathoms below the surface of the ocean, there are no human receptors and impact to any ecological receptors are minimal. The contamination

remaining in the vessel will have minimal impact on the environment because the fate and transport of lead and PCBs in paint indicates that these constituent will not likely leach to the environment under the prevailing pressure, temperature and salinity (Yender, 2009).

The US Navy studied several types of solid PCB products to determine the amount of PCBs that leach out of each type of material in a shallow ocean reef setting. The leach rate study found that the PCBs in the electrical cabling are very stable and that only very small amount of PCBs moved out of the cabling and into the surrounding water over the 2 year study. The results showed that bulkhead insulation has the highest leach rate. A complete risk assessment was conducted for two "high risk groups" – scuba divers and angler fishermen and their families. The results of the risk assessment showed the water will be safe for scuba diving and both adults and children can safely eat fish caught at the artificial reef (U.S. Navy, Fact Sheet).

An ecological risk assessment conducted by the Marine Environmental Support Office, Space and Naval Warfare Systems Center for the Program Executive Office (PEO) Ships for vessel disposal to create shallow artificial reef concluded that total PCB exposure levels predicated by the models showed no indication of risk to plants, invertebrates, fish, sea turtles, and sharks/barracudas that could live, feed, and forage on the reef (PEO Ships, January 2006). The scenario in the study involves sinking a vessel requiring risk-based disposal approval per 40 CFR 761.62(c) for bulk PCBs in solid material at concentrations greater than 50ppm. Based on this study, this alternative will have no impact on any potential receptors and is likely more protective since the vessel will be scuttled at a depth much greater than the shallow reef for which the ecological risk assessment was conducted.

Commented [MN3]: This is a discussion to justify protectiveness at the disposal location and not risk at the current location.

Commented [ETL4]: This entire discussion should be placed in the risk evaluation section, which should also include an uncertainty analysis,

Implementability: This alternative is technically feasible as the technical know-how of such operations exists and firms with demonstrated performance record are available. According to the Department of Transportation Maritime Administration (www.mara.dot.gov) since 2001 more than 100 ships have been disposed. The activities under this alternative can be implemented in a relatively short period of time (less than one year). Equipment, personnel and services to conduct the above activities are readily available. Off-site treatment and disposal facilities are available for wastes requiring disposal. This alternatively is administratively feasible as permitting anticipated is minimal. No easement or right-of-ways for site access are anticipated, and no impacts to any adjoining properties are expected. State and public acceptance of this removal action will be determined during public comments and evaluation of the EE/CA and Action Memorandum.

Cost: The total estimated cost for this alternative is $1,064,221. Since the anticipated time frame for the completion of the removal is less than 12 months, the estimated cost is equal to the capital cost for the base year. As such no present worth costs are calculated, since no operation and maintenance (O&M) cost will be incurred as post removal site control is not required.

Details of the cost estimate and assumptions used are presented in Section 1.1 and Table 1 of Appendix A.

3.1.2 Alternative 2: Ocean Disposal with Full Decontamination

This removal action alternative includes all the activities outlined under Alternative 1. In addition, the following additional activities will be conducted under this alternative:

- Removal and disposal of approximately 60 pounds of electrical wiring
- Removal and disposal of lead-based paint from an area measuring approximately 500,00 square feet
- Removal and disposal of PCB paint from an area measuring approximately 12,000 ft^2

Following removal, the vessel will be prepared and secured, and disposed as described under Alternative 1.

Effectiveness: This alternative will permanently remove the source of contamination from the current location, eliminate potential exposure routes, and protect public health, the environment and ecology of the Columbia River, and the community. Additionally, this alternative removes lead and PCBs in the solid materials on the vessel, thereby minimizing any impact at the disposal location. Short-term, there is a potential exposure to the workers preparing the vessel for removal. However, this can be minimized by use of BMPs, engineering controls and appropriate personal protective equipment. Residual contamination may remain in place in the water column and sediment, but is not expected to pose short-term or long-term threat to human health and the environment. At the disposal location, at the bottom of the ocean, there are no human receptors that will come into contact with any residual contamination and it is expected that lead and PCBs will be removed from the vessel entirely leaving no source of contamination. This alternative complies with the ARARs identified in Section 2.4, and meets the RAOs as it removes all potential contamination and no concerns of residual effect exist. The final disposition of the vessel is a long-term solution that will be implemented to address the current conditions and concerns.

Implementability: This alternative is technically feasible as the technical know-how of such operations exists and firms with demonstrated performance record are available. The activities under this alternative can be implemented in a relatively short period of time (less than one year). Equipment, personnel and services to conduct the above activities are readily available. The complexities introduced by the removal and disposal of PCB and lead paint surfaces are reflected in the higher cost of this alternative, but do not affect its technical feasibility. Off-site treatment and disposal facilities are available for wastes requiring disposal. This alternatively is administratively feasible as permitting anticipated is minimal. No easement or right-of-ways for

site access are anticipated, and no impacts to any adjoining properties are expected. State and public acceptance of this removal action will be determined during public comments and evaluation of the EE/CA and Action Memorandum.

Cost: The total estimated cost for this alternative is $13,799,942. Since the anticipated time frame for the completion of the removal is less than 12 months, the estimated cost is equal to the capital cost for the base year. As such no present worth costs are calculation, since no O&M cost will be incurred as post removal site control is not required. A significant cost of this alternative is for the lead and PCB removal which is not a component of Alternative 1. Details of the cost estimate and assumptions used are presented in Section 1.2 and Table 2 of Appendix A.

3.1.3 Alternative 3: Decontamination, Dismantling and Recycling/Disposal

This removal action alternative incorporates all the activities outlined under Alternative 2, except the disposition of the vessel. However, some of the activities outlined in Alternative 2 are conducted in different sequences and locations. The following activities are unique to Alternative 3:

- After removal and treatment of approximately 500,000 gallons of non-oily water and securing equipment onboard, the vessel will be then towed using tugs to a dry dock.
- Removal and disposal of the solid and hazardous materials outlined in Alternative 2 will be carried out at the dry dock.
- After removal and disposal of the lead and PCB removal, the superstructure and any other recyclable materials will be segregated from non-recyclable solid wastes for recycling/disposal.
- It is anticipated that approximately 2,400 tons of steel/metal will be recycled.

Effectiveness: This alternative will permanently remove the source of contamination, eliminate potential exposure routes, and protect public health, the environment and ecology of the Columbia River, and the community. Short-term, there is a high potential exposure to the workers preparing the vessel for removal and dismantling. However, this can be minimized by use of BMPs, engineering controls and appropriate personal protective equipment. No residual contamination is expected to remain once removal is complete. This alternative complies with the ARARs identified in Section 2.4, and meets the RAOs as it removes all potential contamination and no concerns of residual effect exist. The final disposition of the vessel is a long-term solution that recycles/disposes the vessel and its contents in an appropriate manner.

From the standpoint of green remediation principles, this alternative would be effective at reducing the carbon footprint through recycling the scrap steel/metal comprising the vessel, and produce economic benefit at the steel/metal end of life cycle.

Implementability: This alternative is technically feasible as the technical know-how of such operations exists and firms with demonstrated performance record are available. The activities under this alternative can be implemented in a relatively short period of time (less than one year). Equipment, personnel and services to conduct the above activities are readily available. The complexities introduced by the removal and disposal of PCB and lead paint surfaces, and dismantling of the vessel are reflected in the higher cost of this alternative, but do not affect its technical feasibility. Off-site treatment and disposal facilities are available for wastes requiring disposal. This alternatively is administratively feasible as permitting anticipated is minimal. No easement or right-of-ways for site access are anticipated, and no impacts to any adjoining properties are expected. State and public acceptance of this removal action will be determined during public comments and evaluation of the EE/CA and Action Memorandum.

Cost: The total estimated cost for this alternative is $13,072,032. Since the anticipated time frame for the completion of the removal is less than 12 months, the estimated cost is equal to the capital cost for the base year. As such no present worth costs are calculation, since no O&M cost will be incurred as post removal site control is not required. Dismantling a ship a complex and costly task, however, this cost is offset by the benefits realized from recycling the vessel's scrap steel/metal. A significant cost of this alternative is for the lead and PCB removal which is not a component of Alternative 1. Details of the cost estimate and assumptions used are presented in Section 1.3 and Table 3 of Appendix A.

4.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

In this section, removal action alternatives are analyzed against the three criteria as outlined in the NTCRA Guidance: effectiveness, implementability, and cost. Each of these criteria is described below.

> Effectiveness: How well each alternative (1) protects public health and the environment, including long-term effectiveness and permanence and short-term effectiveness, (2) complies with ARARs, and (3) achieves removal objectives.
>
> Implementability: The technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation.
>
> Cost: The direct and indirect capital costs and annual post removal site control (PRSC) costs associated with an alternative.

The analysis of the three alternatives with regard to these three criteria is presented in Section 3.0.

Below is a summary of comparative evaluation of the alternatives with regard to effectiveness, implementability and cost. These Alternatives are:

Alternative 1: Ocean Disposal with Limited Decontamination

Alternative 2: Ocean Disposal with Full Decontamination

Alternative 3: Decontamination, Dismantling and Recycling/Disposal

Effectiveness: All three alternatives are protective of public health, the environment and ecology of the Columbia River, and the community. All three alternatives permanently remove the source of contamination to humans and ecology of the Columbia River. However, because of the level of decontamination and final disposition of the vessel, Alternative 3 has a benefit over the other two alternatives as no disposal in the ocean will occur and environmental benefits from recycling will be achieved. Similarly, Alternative 2 provides a level of decontamination that does not allow disposition of COPCs at the bottom of the ocean.

All three alternatives will have potential short-term impact on workers; however, this impact is minimal for Alternative 1. The degree of potential short-term impact is greater for Alternatives 2 because of the level of decontamination and much higher for Alternative 3 because of the dismantling activities. The short-term impact can be mitigated by implementing BMPs, engineering controls and appropriate personal protective equipment.

All three alternatives meet the ARARs and the removal action objectives as they permanently remove the source of contamination and eliminate the exposure routes. Although in Alternative 1 the decontamination is minimal, there are not exposure routes that are complete at the vessel's disposal location and risk assessment by the Navy has shown no impact from similar contamination at a coral reef setting. Therefore, no residual effect on human health and the environment is anticipated.

Implementability: All three alternatives are technically feasible, because the know-how of the operations for these alternatives exists, and firms with track record in decontamination, dismantling or scuttling a ship are available. Equipment and personnel are readily available for all three alternatives. There are varying degrees of difficulty in implementing each alternative. Alternatives 1 and 2 present the challenge of safely sinking the ship to the bottom of the ocean, and Alternatives 3 presents the challenge of dismantling the vessel and segregation of recyclable materials from the solid/hazardous waste for disposal. These degrees of difficulties are reflected in the cost and do not impact the technical feasibility of each alternative. All three alternatives can be implemented in a relatively short period of time (less than 12 months). All three alternatives are administratively feasible as no easement or right-of-ways for site access are anticipated, and no impact to any adjoining properties is expected. There will be permit requirements for Alternatives 1 and 2 for the ocean disposal. No permits are anticipated for Alternative 3.

Cost: The detailed estimated costs for the alternatives are presented in Tables 1 through 3 in Appendix A. Since the removal actions will be completed within a period of 12 months all costs are capital cost of the base year (2011). The total estimated costs of the alternatives are $1,064,221, $13,799,942 and $13,072,032 for Alternatives 1, 2, and 3, respectively. The costs for Alternatives 2 and 3 are similar, but higher than the cost of Alternative 1 by orders of magnitudes.

The cost estimates in this EE/CA are based on the description of the alternatives and associated assumptions presented in this EE/CA. The assumptions used here are reflective of the activities anticipated and sufficient for the purposes of comparative evaluation of the alternatives, but are not necessarily the same as the design basis that would be used for the final, detailed design.

The cost estimates were prepared to allow comparative evaluation of alternatives, not for budgeting purposes. The uncertainties in the EE/CA designs and associated cost estimates are such that actual costs could vary significantly from these estimates. However, the uncertainty in the *relative* cost of the alternatives is much less than the uncertainty in the magnitude of the costs, and these cost estimates are suitable for comparative evaluation of the alternatives.

This evaluation reveals that Alternative 1 provides the best value for comparable level of effectiveness and implementability. Table 4.1 summarizes the comparative analysis.

Table 4.1: Comparative Analysis Summary

NTCRA Criteria	Alternative 1: Ocean Disposal with Limited Decontamination	Alternative 2: Ocean Disposal with Full Decontamination	Alternative 3: Decontamination, Dismantling and Recycle/Disposal	Comment
Effectiveness:	Protective of public health and community, and ecology. Protective of workers and the environment. Leaves contaminants in the vessel at disposal location. Achieves ARARs and meets RAOs by eliminating exposure routes.	Protective of public health and community, and ecology. Protective of workers and the environment. No residual concern at disposal location. Achieves ARARs and meets RAOs by eliminating exposure routes.	Protective of public health and community, and ecology. Protective of workers and the environment. Achieves ARARs and meets RAOs by eliminating exposure routes.	Although risk assessment for a scenario at a shallower depth showed no risk from the level contamination on the vessel, Alternative 3 is rated the highest since ocean disposal is not part of this alternative. The other two are rated relative the level of decontamination achieved.
Effectiveness Score	**4**	**4.5**	**5**	
Implementability	Technically feasible. Know-how, equipment and personnel are readily available. No easements or right-of-way required. No impact to adjoining properties anticipated. Minimal permitting for ocean disposal.	Technically feasible. Know-how, equipment and personnel are readily available. No easements or right-of-way required. No impact to adjoining properties anticipated. Minimal permitting for ocean disposal.	Technically feasible. Know-how, equipment and personnel are readily available. No easements or right-of-way required. No impact to adjoining properties anticipated. No permitting anticipated.	The permitting required for Alternative 1 is anticipated to be more complex than the permitting required for Alternative 2 due to the different levels of decontamination. Cost offsets any complexities in implementation.
Implementability Score	**4**	**4**	**4**	
Cost	$1,064,221	$13,799,942	$13,072,032	
Cost Score	**5**	**2**	**2**	
Total Score	**13**	**10.5**	**11**	

Score Range: 5 (Fully Meets Criterion) to 1 (Does Not Meet Criterion)

5.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Alternative 1 best satisfies the evaluation criteria based on the comparative analysis in Section 4.0.

In summary, all three alternatives provide similar levels of protectiveness, and have similar levels of implementability. However, the costs of Alternatives 2 and 3 are both orders of magnitudes higher than the cost of Alternative 1. The additional activities under Alternatives 2 and 3 provide marginal benefits to the protection of human health and the environment. This significant additional cost for a marginal benefit does not justify the selection of either of the alternatives. Therefore, Alternative 1, Ocean Disposal with Limited Decontamination is recommended as the removal alternative.

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PHOTOS

Photo 1

Photo # K-78101 USS Washtenaw County moored in Subic Bay, October 1969

FIGURES

Figure 1: Site Location Map

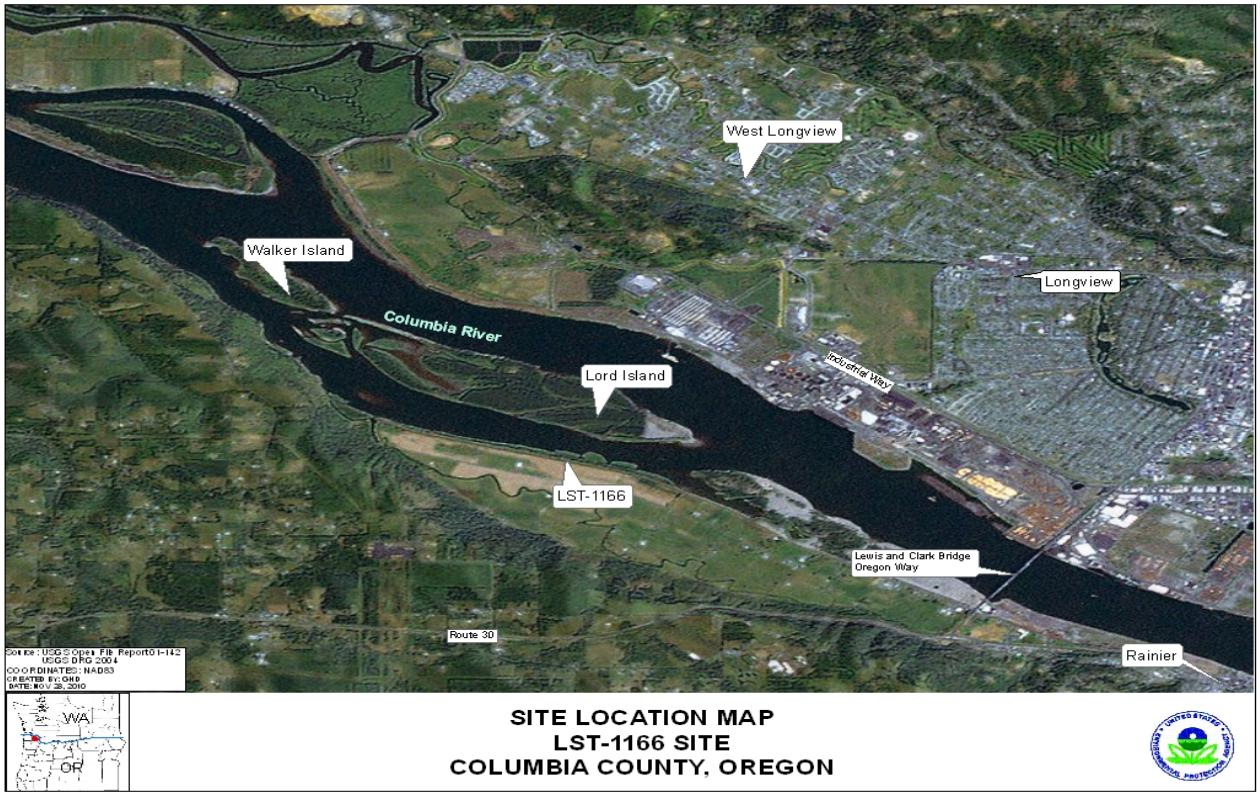
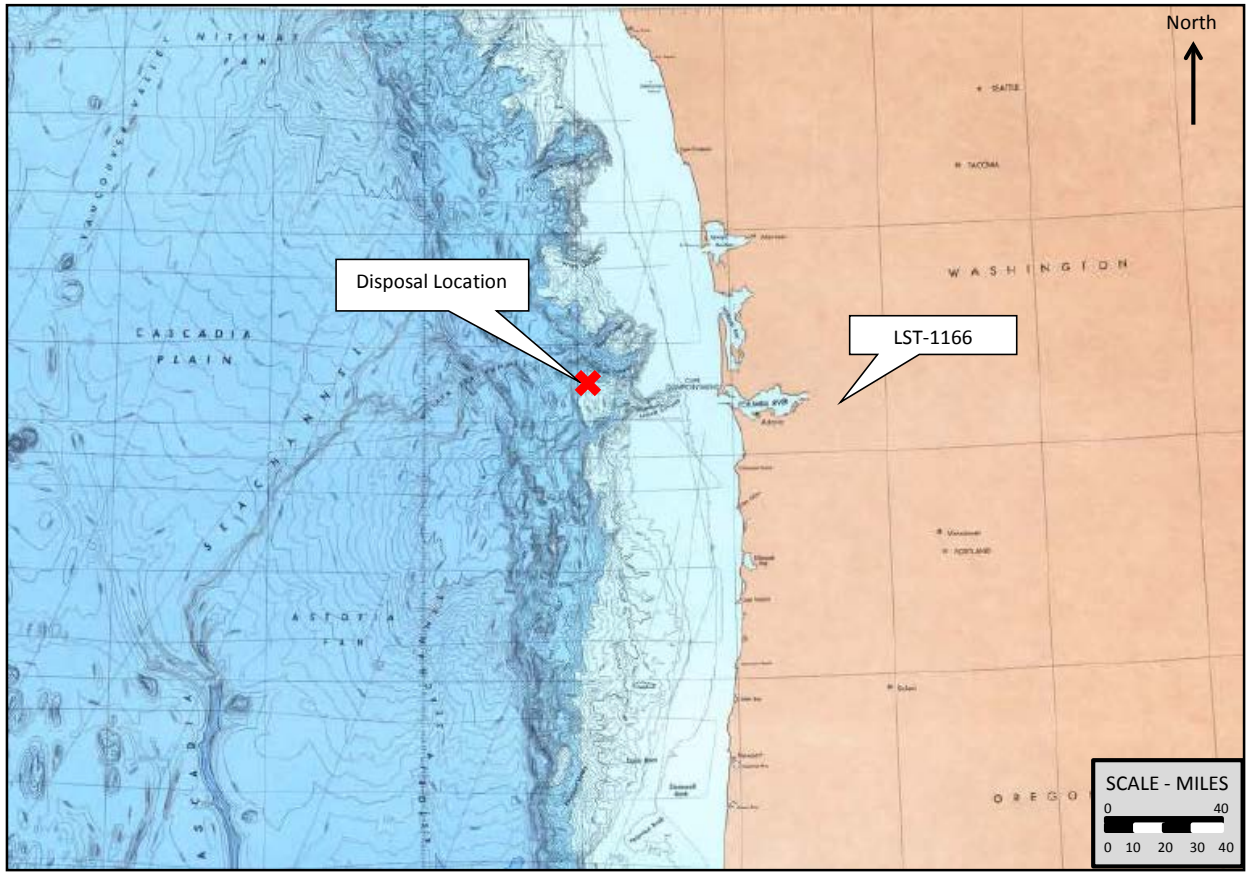


Figure 2: Disposal Location Map



APPENDIX A

A.1 Cost Estimates

Cost estimates were prepared for each of the three removal alternatives; 1) Ocean Disposal with Limited Decontamination, 2) Ocean Disposal with Full Decontamination, and 3) Upland Disposal. The accuracy of the estimates may vary because details may change when the removal action is designed.

The general and specific assumptions used to generate the cost estimates are presented herein. The cost estimate tables; including quantities, unit costs, contingencies, overhead, profit, permitting and health and safety for the site are presented in Tables 1 through 3. Specific line item assumptions are also included within these tables. The costs presented in these tables are estimated based on vendor quotes, RS Means, professional experience and/or the assumptions stated. RS Means' 2004 Environmental Remediation Cost Data – Unit Price and RS Means' 2004 Environmental Remediation Cost Data – Assemblies were used for certain unit costs estimates as indicated. Costs have been escalated from 2004 to 2011 using a 2.7% inflation rate, based upon the rates published in Appendix C of Circular A-94 Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs (United States Office of Management and Budget, January 2009).

Since the anticipated time frames for all three alternatives is less than 12 months and on-going operations and maintenance costs are not applicable to the removal alternatives, Present Worth costs were not calculated and Capital Costs were used as the basis for estimating total costs and in alternatives comparison.

Due to the limited information/documentation on the LST 1166, a contingency allowance of 20% was utilized for each alternative. Costs assume a health and safety personal protective equipment level (PPE) of modified D except where contaminant specific procedures require more stringent protection (e.g. lead-based paint removal).

For certain cost estimate line items, an additional contingency (usually 100%) is applied for activities that require complicated access issues.

The following sections present the assumptions used for each alternative.

A.1.1 Alternative 1: Ocean Disposal with Limited Decontamination

The following general assumptions were used to generate a cost estimate for Alternative 1:

- Removal and disposal of approximately 2,000 pounds of solid/hazardous waste
- Removal and disposal of approximately 200 pounds of friable paint chips

- Removal and disposal of approximately 400,000 pounds of foam
    - Non-hazardous disposal
- Removal and treatment of 500,000 gallons of non-oily water
    - Pumped through a carbon filter and discharged back into the river
- Securing equipment on-board the vessel
- Preparation of deck and superstructure
- Preparation of below deck
- Preparation of hull
- Towing and scuttling of the vessel 65 nautical miles from the mouth of the Columbia River
-

Additional descriptions and assumptions for specific lines items are included in Table 1.

A.1.2 Alternative 2: Ocean Disposal with Full Decontamination

The following general assumptions were used to generate a cost estimate for Alternative 2:

- Removal and disposal of approximately 2,000 pounds of solid/hazardous waste
- Removal and disposal of approximately 200 pounds of friable paint chips
- Removal and disposal of approximately 400,000 pounds of foam
    - Non-hazardous disposal
- Removal and treatment of 500,000 gallons of non-oily water
    - Pumped through a carbon filter and discharged back into the river
- Removal and disposal of lead-based paint from an area measuring approximately 500,00 square feet (ft^2)
- Removal and disposal of PCB paint from an area measuring approximately 12,000 ft^2
- Securing equipment on-board the vessel
- Preparation of deck and superstructure
- Preparation of below deck
- Preparation of hull
- Towing and scuttling of the vessel 65 nautical miles from the mouth of the Columbia River

Due to the length of time needed to complete full decontamination of LST 1166, this alternative also assumes that Barge, Tug, Light Crane (with Crew) would be required for a period of 12 months to provide access. Additional descriptions and assumptions for specific lines items are included in Table 2.

A.1.3 Alternative 3: Decontamination, Dismantling, Recycling and Disposal

The following general assumptions were used to generate a cost estimate for Alternative 3:

- Removal and treatment of approximately 500,000 gallons of non-oily water
    - Pumped through a carbon filter and discharged back into the river

After the above removal actions are completed, the vessel will prepared for transport and dry docking including:

- Securing equipment on-board the vessel
- Preparation of deck and superstructure
- Preparation of below deck
- Preparation of hull

The vessel will be then towed using tugs to a dry dock located in the Portland area. At the dry dock the following activities will be completed:

- Removal and disposal of approximately linear 60 pounds of electrical wiring.
- Removal and disposal of approximately 2,000 pounds of solid/hazardous waste
- Removal and disposal of lead-based paint from an area measuring approximately 500,00 ft^2
- Removal and disposal of PCB paint from an area measuring approximately 12,000 ft^2
- Removal and disposal of approximately 1,000,000 pounds of foam
    - Non-hazardous disposal

This estimate also assumes that the dry dock period will be 2 months. A substantial cost savings for recycling steel is included in this cost estimate. Additional descriptions and assumptions for specific lines items are included in Table 3.

A.2 Cost Estimate Tables